Radio-micrometers magnetometers, and every other meter the motion of whose index must be greatly magnified, will become simply museum specimens, illustrating the blindly commercial enterprise of Englishmen, who removed from Trafalgar Square the statue of Jenner, because he only showed us how to save countless lives in every country, and was not distinguished, like the people whose statues remain, by killing many to add to England's landed estate. The 3-foot telescope now being erected in Exhibition Road, will, of course, become useless when the earth-shaking train goes whirling underneath it. Why not leave it at once, like a broken monumental column, to mark the spot where lies buried many a noble hope?

But those who know, from past experience, how "great effects from little causes spring," already ask whether the scientific education of many, and the carrying on of scientific researches, such as have already been conducted in the laboratories in Exhibition Road, may not be worth more to the nation than any number of twopenny-ha'penny railway fares.

And others, whose only claim to be heard is the possession of that rarest of all senses—common sense—ask, Can it be possible that the nation, after having spent such vast sums on the erection and equipment of these laboratories, will now permit them to be rendered well nigh useless?

To move the laboratories of applied science is as undesirable as it is now impossible. Lord Carlingford, at their opening, congratulated the nation that a site had been selected for them close to the Museums, and stated that the French had even just moved the École Centrale of Paris, so that it might be placed in close proximity to the Conservatoire des Arts et Métiers. It is not likely that we shall now reverse our policy, divorce our Schools from our Museums, and, in securing such a result, waste all that has already been spent. If a railway is needed between South Kensington and Tyburnia, let it go under Queen's Gate, and not "Round by the Serpentine under the trees," as sung Lord Algernon. The Muse utters a cry of distress, let us join with her in shouting—

"Procul, oh! procul, este profani."

THE PALÆOZOIC FISHES OF NORTH AMERICA.

The Palæozoic Fishes of North America. By John Strong Newberry. (Monograph of the United States Geological Survey, No. XVI., dated 1889, issued August 1890.) Pp. 228, Pls. liii. (Washington: Government Printing Office.)

NEARLY all of importance that has hitherto been written concerning the Palæozoic fishes of the United States has proceeded from the pen of Prof. J. S. Newberry, of Columbia College, New York, whose numerous contributions during the last thirty years are to be found both in the American journals and periodicals, and in the beautifully illustrated volumes of a few of the State Surveys. Some of these contributions form extensive memoirs and are accompanied by numerous figures; but many are scattered notices without adequate illustration, relating to subjects worthy of much more elaborate treatment. The newly organized United States Geological Survey thus did good service to palæichthyology when it undertook, some time ago, to publish an extended monograph summarizing the whole of Dr. Newberry's researches and bringing them up to date. The result of the undertaking is the fine quarto volume now before us, which not only deals with forms already described, but also makes known a large amount of valuable new material, which the author has assiduously collected from various sources, and, for the most part, added to the unique collection in the Columbia College Museum.

The monograph occupies 228 pages, printed in the Survey's usual excellent style; and there are 53 plates, of which, unfortunately, little complimentary can be said. Eight of the latter are inferior process-reproductions of plates that have already appeared elsewhere, and many of the others are so carelessly produced by the same photographic method, that they give a very imperfect idea of the fossils they are supposed to represent.

Dr. Newberry treats the subject in stratigraphical order, and deals almost exclusively with the fishes of the Devonian and Carboniferous periods. Two pages only are devoted to the recent discovery of Upper Silurian fishes by Prof. Claypole; and no reference whatever is made to the few interesting Palæozoic types briefly described some years ago by Prof. Cope, from the Permian of Texas. The information concerning Devonian and Carboniferous genera, however, is most copious, accompanied by numerous references to literature; and we can only regret that the author did not continue his researches further into taxonomy, thus arranging the forms of each great period in some definite zoological order.

The limits of the Devonian age adopted by Dr. Newberry are somewhat different from those accepted by most American authors, and we doubt whether the inclusion of the Chemung and Catskill groups in the Carboniferous series will be generally accepted by either American or European geologists. The fish-fauna of each of these groups is certainly not Carboniferous, as ordinarily understood. Dr. Newberry considers that the Devonian series in the United States consists of the Oriskany (Lower), Corniferous (Middle), and Hamilton (Upper) groups; and the only fish-remains worthy of description are those from the two latter horizons. The account of the Corniferous fishes occupies 24 pages, and comprises little that is new, being almost exclusively a verbatim reprint from the Ohio Survey Reports of 1873 and 1875. A plate, illustrating several of the bones of the problematical Ganoid *Onychodus*, is the most important addition; and the remarks on the armoured fish *Macropetalichthys* constitute the most serious error that modern researches ought by this time to have eradicated. The fishes of the Hamilton group include more novelties, among which may be specially noted the triturating dental pavement apparently of an Elasmobranch (*Goniodus*), in addition to a new type of ribbed Ichthyodorulite (*Heteracanthus*), resembling in shape the well-known Carboniferous *Physonemus*.

The Chemung, Catskill, and Waverly groups constitute the Lower Carboniferous in Dr. Newberry's classification; and the series of limestones that contain the same fish-fauna as the lowest beds of the British Mountain Lime-

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stone are termed Middle Carboniferous. Indeed, looking at the subject from the point of view of physical geology, Dr. Newberry adopts a well-known principle, and also assigns the whole of the Carboniferous Limestone of Western Europe to the middle portion of the Carboniferous epoch, considering that this great division of time terminates with the upper limit of the Permian. The fishes of the Chemung and Catskill groups comprise, among others, the genera *Palædaphus* (*Heliodus*), *Phyllolepis*, *Bothriolepis*, *Onychodus*, *Holoptychius*, and *Glyptopomus*, all of which are essentially characteristic of the Old Red Sandstone and Devonian of Europe, and are never found in the lowest mechanical sediments of the Carboniferous system even in Scotland; while the remarkable new genus *Holonema* is more suggestive of a Devonian Coccostean than of any later type. The fishes of the Waverly group, on the other hand, agree in general character with those of the Calciferous Sandstone and Carboniferous Limestone series of Scotland, except in one particular—namely, the occurrence in certain American horizons of the remarkable gigantic "Placoderms," to which Dr. Newberry has given the names of *Dinichthys*, *Titanichthys*, *Trachosteus*, *Glyptaspis*, &c.

The detailed descriptions of these genera constitute the most important part of the present volume, and add most materially to existing knowledge of the subject. *Dinichthys* is essentially a huge *Coccosteus*, often with jaws two feet in length. *Titanichthys* is a still more gigantic fish, the head sometimes measuring four feet across, and the long, slender, toothless jaws were apparently provided during life with a horny sheath. Some of the remaining genera are also noteworthy for the elaborate ornamentation of their armour; while at least one other (*Mylostoma*) has loose dental plates very suggestive of those of certain Chimæroids and Dipnoi. The series of *Dinichthys* and its allies in the Museum of Columbia College is, indeed, one of the most remarkable exhibitions to be seen in the institutions of the United States, and deserves the closest attention of all interested in the earliest types of fish life.

A contemporaneous Elasmobranch, occurring in the same formation as *Dinichthys*, is also a most striking addition to the Palæozoic fauna; but it is not described, and only forms the subject of two unsatisfactory plates. The dentition is Cladodont, and the species is named *Cladodus fyleri*, while the anterior half of an allied fish is both described and figured under the name of *Cladodus kepleri*. This form of Elasmobranch has small pectoral fins, with an abbreviated basipterygium, and the cartilaginous rays all extending to the outer border; the tail is attenuated, diphycercal, with a pair of horizontal dermal expansions at its base; there are apparently no dorsal fin-spines; and the orbit is surrounded by a complete ring of four ornamented dermal plates. The fish is altogether different from any hitherto found in Europe provided with *Cladodus*-shaped teeth, and increases the already considerable difficulties surrounding the classification of the predaceous Palæozoic sharks.

The discovery of an undoubted *Rhizodus* in the Carboniferous Limestone of Illinois is another fact of some interest; though in this case, as in several others, the author unfortunately omits to mention that the fossil has already been described, without figure, in the publications of the New York Academy. Several fossil teeth and spines of Elasmobranchs are also discussed from the same formation; and the final section of the work is a brief summary of the fishes of the American Coal-measures, accompanied by a reprint of the author's memoir on *Edestus*, which appeared in the Annals of the New York Academy in 1888. The last-mentioned fossil is still problematical, but is considered to be most nearly paralleled by the group of spines met with upon the tail of the existing *Trygon*.

Dr. Newberry's researches have excited so much interest among geologists residing in the neighbourhood of Palæozoic formations in the United States, that Columbia College is the destination of nearly all new discoveries of Palæozoic fishes from every quarter. So much has thus accumulated since the completion of the manuscript for the present monograph, that we understand the author contemplates the issue of an extensive supplement. That such an additional contribution may soon appear will be the wish of all naturalists interested in this line of research.

A. S. W.

HAND-BOOK FOR MECHANICAL ENGINEERS.

Hand-book for Mechanical Engineers. By Prof. Henry Adams, M.Inst.C.E. (London and New York: E. and F. N. Spon, 1890.)

THIS useful book is practically a new and improved edition of Prof. Adams's previous work, "Notes in Mechanical Engineering" The older work has been recast, and much additional matter added to render it of more use to mechanical engineers and to raise it above the level of the ordinary text book. The author rightly observes that busy men must have facts and opinions put before them as briefly as possible, and this is his reason for condensing the information in the book to a compact yet clear form. The work is sure to be an acceptable one to mechanical engineers. The information has in most cases been taken from trustworthy sources, and these are duly acknowledged. It is a pity that the index has not been differently arranged, for there is nothing more annoying when picking up a book of this kind in order to obtain some particular formula or information than to find that it is necessary to settle in one's mind what section it is likely to be in, and then have to search down the columns for a likely paragraph. Had the index been an alphabetical one pure and simple, the handiness of the book would have been greatly enhanced. In some few cases it will be observed that data are quoted from amateur engineering papers. These may be perfectly correct; at the same time the "busy man" will probably doubt their value and trustworthiness.

The book covers an extensive field of mechanical engineering, most branches being well treated. Some of the information, however, is antiquated; for instance on p. 27, we are told that wrought iron is used for "rails." We presume railway rails are here meant. It must be very many years since the last iron rails were rolled for that purpose, and it is possible that there are no works left in this country where the old iron plant is in existence. On the same page it is stated that Yorkshire iron from Lowmoor, Bowling and other forges is used for

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